CT Chest at discharge in Hospitalized Covid-19 patients: Should we worry about the long term evolution of parenchymal lesions?

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Research Article

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Abstract

Objectives: Covid-19 epidemic has led to thousands of hospitalized patients and the fear of long-term pulmonary sequelae is real. This preliminary study aimed at describing the pattern of lung parenchymal lesions in patients at the time of clinical recovery.

Methods

Patients who were hospitalized for a severe Covid-19 pneumonia and who underwent a CTchest less at the time of discharge were included. CT scan parenchymal lesions were classified using international recommendations and compared to the diagnostic CT scan. **Results**

We included 32 patients, median age 57 yo [26-89]. Out of them, 10 patients required ICU admission. The median hospital stay was 12 days [4-28]. All CT chest at discharge showed persistent parenchymal abnormalities regardless of the time of clinical recovery or ICU requirement. The main radiological pattern at admission was bilateral ground glass opacities in 28/30 (93.3%), associated in 12 patients (40%) with areas of consolidation, and organized pneumonia in 8 patients (27%). At discharge, the main radiological pattern remained bilateral ground glass opacities in 29/32 patients (91%) associated with consolidation in 3/32 patients (9%) and organized pneumonia in 25/32 patients (78%). There was no correlation between lesions extent and clinical severity, particularly ICU requirement. Conclusion CT-chest of patients recovering from severe covid-19 show parenchymal persistent abnormalities: careful consideration of the organisation of recovery of lung function follow-up is thus needed and the question of antifibrotic agent usefulness may be anticipated.

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Background

Key points:

Despite favorable clinical course, CT chest at discharge for patients hospitalized with Covid-19 pneumonia showed 100% persistent abnormalities after a median stay of 12 days. Further follow-up is required to determine whether these changes are reversible.

With 5 307 298 confirmed cases in 216 countries and 342 070 confirmed deaths the 25th of May 2020, Coronavirus disease (Covid-19) is one of the largest outbreaks of the 21st century which has led to massive containment measures worldwide. All medical facilities have gathered to fight the SARS-Cov2 infection when the outbreak reached its peak, with only vital emergencies taken car off outside of this disease[1]. Given the limited access to PCR screening in France and the high positive predictive value of

CT chest during the pandemic, physicians have relied on imaging for Covid-19 diagnosis in selected patients in order to timely start medical management and protective measures[2]. Bilateral ground glass opacities associated or not with consolidations were the main lesions seen on chest CT scan[2,3]. The extent of lesions at baseline has been proved to be predictive of worse outcomes and ICU admission[3]. However, whether lesions evolution would impact short and long-term lung parenchymal recovery remains unclear. Given the known 62% rate of fibrosis pattern on 1-month follow-up chest CT scan in SARS patients in early 2000's, SARS-Cov2 induced lung parenchymal lesions evolution could be expected in hospitalized patients with severe lesions[4]. Therefore, we aimed to describe in a population of hospitalized Covid-19 patients, the evolution of parenchymal lung lesions on CT chest, between admission and prehospital discharge after oxygen weaning.

Methods

We restrospectively analyzed datas from a propsective institutional Covid-19 database (Covid GHPSJ Database, IRB number 00012157). Patients referred to our center for severe Covid-19 pneumonia between the 15th of March and the 9th of April 2020 were retrospectively included from the database. Patients who underwent a CT chest less than 24h before discharge were included, discharge criteria were for all patients at least 48 hours of oxygen weaning and a clinical status authorizing home return. Discharge CT-scan were routinely performed during the week-day and were compared to the baseline chest CT scan when available. CT scan parenchymal lesions were classified using international recommendations for the scoring of Covid-19 lung parenchymal extension[5]. Two radiologists studied and compared images in consensus.

Results

A total of 32 patients, (20 men/ 12 women), median age 57 yo [26-89], with a median body mass index of 28.6 kg/m^2 [19-44] were included in the study. Out of them, 10 patients required ICU admission and one patient developed deep venous thrombosis and pulmonary embolism. There was no significant difference between patients requiring and not requiring ICU admission regarding the age, BMI and CT score at admission. The median time between onset of symptoms and admission was 7.9 days [0-19] and the median hospital stay was 12 days [4-28]; respectively 18 days [12-28] for ICU patients and 9 days [4-20] for non ICU patients (p=0.0006). All CT chest at discharge (100%) showed persistent parenchymal abnormalities regardless of the time of clinical recovery or ICU requirement. The evolution of the parenchymal abnormalities on CT scans between admission and discharge was a decrease of the abnormalities in 12 patients, increase in 9 and stability in 9 (2 baseline CT were not available) (illustrations in Figure). The main radiological pattern at admission was bilateral ground glass opacities in 28/30 (93.3%), associated in 12 patients (40%) with areas of consolidation and organized pneumonia in 8 patients (27%). At discharge, the main radiological pattern remained bilateral ground glass opacities in 29/32 patients (91%) associated with consolidation in 3/32 patients (9%)and organized pneumonia in

25/32 patients (78%). There was no correlation between lesions extent and clinical severity, particularly ICU requirement.

Discussion

Covid-19 pneumonia conducted thousands of patients across the world to lung dysfunction requiring massive hospitalization. It is still a novel disease with poorly understood pathogenesis and no specific standard of care. The lungs are the prmiary targeted organs and their involvement is the leading cause of mortality[6]. Whether or not viral parenchymal aggression will lead to late sequelae is still unknown. However, our study shows that while patients exhibit clinical improvement authorizing discharge, extended lung parenchymal abnormalities persist. These findings are consistent with recent studies describing the course of parenchymal lung abnormalities evolution during Covid-19 pneumonia[7,8]. Pan et al demonstrated the greatest extent 10 days after initial onset of symptoms in a cohort of 21 patients requiring hospitalization[7], while Wang et al described 94% of parenchymal abnormalities on CT chest at discharge in a cohort of 70 patients with a median illness duration of 24 days from onset of symptoms[8]. In our cohort, we describe 100 % persistent lung parenchymal abnormalities on CT chest after a median of 20 days after the onset of symptoms, (maximum length of 34 days). Understanding whether persistent abnormalities represent a delayed radiological resolution of the lesions or could be an early indication of future lung fibrosis is crucial. Follow-up of patients is mandatory to determine if the significant abnormalities observed in the vast majority of patients at hospital discharge persist over time, and if they are responsible for chronic symptoms and lung function decline. The French-language Respiratory Medicine Society recently edited a guide for the follow-up of patients with SARSCoV2 pneumonia and suggested 3 months follow up with both functional tests and CT chest for patients who had required hospitalization[9]. Indeed, during H7N9 outbreak, a virus with high lethality rate, Chen and colleagues reported persistent CT scan abnormalities up to one year in 85.4% of patients (35/41), with ground glass opacities, reticulations, and bronchiectasis[10]. Some abnormalities diagnosed three months after viral pneumonia improved over time but most persisted.

Conclusion

This Covid-19 pandemic exhibits some specific features compared to most strains of flu or to other viral pneumonia that make the follow-up of patients of great importance : high contagiousness, rapid spread of the virus, and significant proportions of young people without apparent comorbidity with severe form of the disease. Given the number of infected patients, careful consideration of the organisation of recovery of lung function follow-up is needed[11]. We should remain vigilant and the question of antifibrotic agent usefulness may be asked[12].

Declarations

Data from a propsective institutional Covid-19 database: Covid GHPSJ Database, IRB number 00012157

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

The authors declare that they have no competing interests.

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Ethics

We received an approval for the study by the local research ethics committee with the IRB number 00012157

Consent

The need for consent for the present study was waived by the approving ethics committee.

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Figures

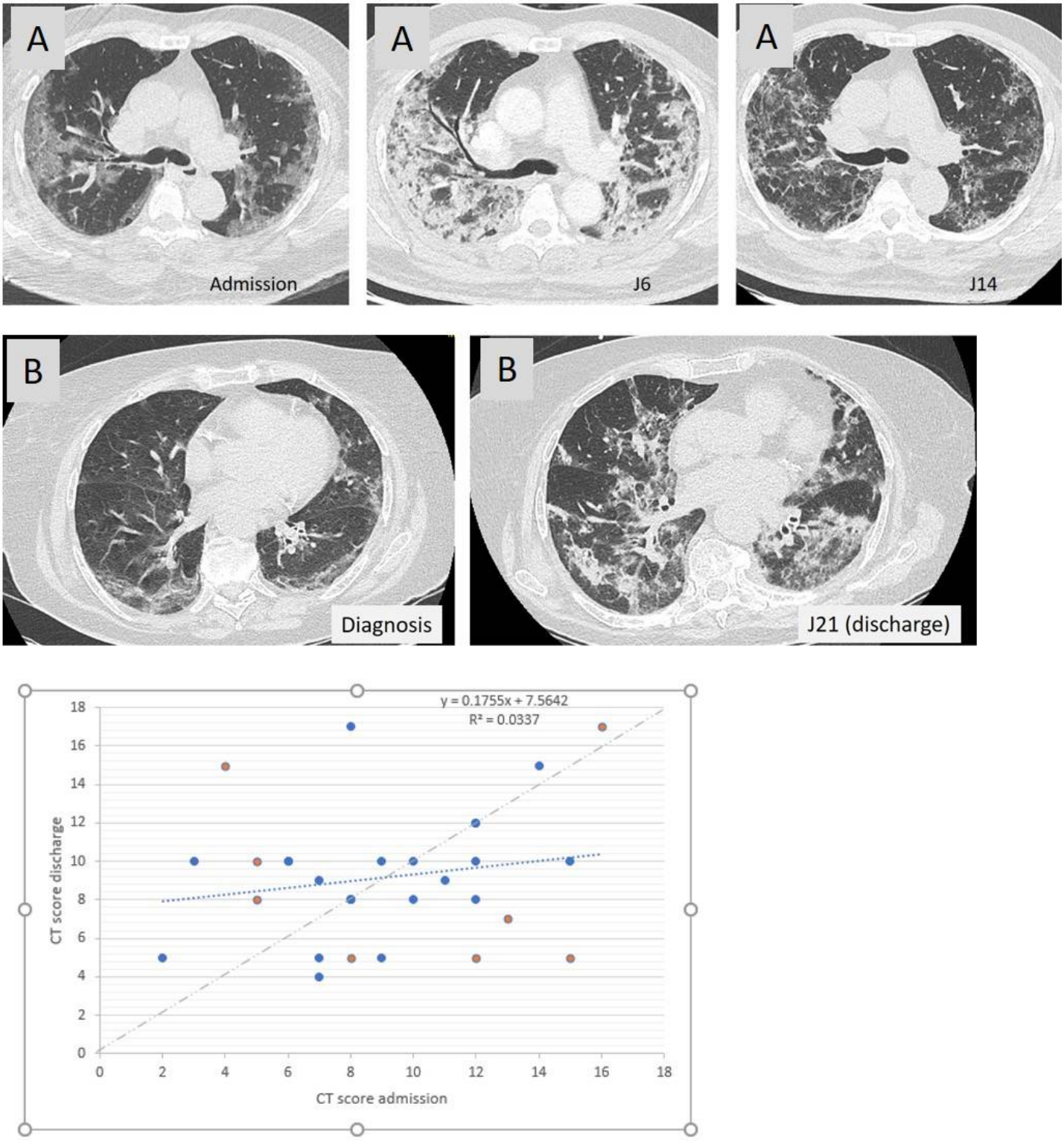

Figure 1

Patient A: Illustration of a 62 yo patient (BMI 24) hospitalized for COVID19 pneumonia (positive RT-PCR) requiring ICU admission. First symptoms were reported 8 days before admission. CT images at admission (2nd of april), at J6 for accute worsening of dyspnea and at discharge (J14). A bilateral ground glass opacities pneumonia was noticed at diagnosis, replaced by area of consolidation at J6 and improvement of images, without complete resolution at discharge. The extent of the abnormalities firstly

worsened and remains stable at discharge. - Patient B: Illustration of a 89 yo patient (BMI 31.6) hospitalized for COVID19 pneumonia (positive RT-PCR) requiring oxygen therapy. First symptoms were reported 9 days before admission with a maximum O2 requirement of 12L/min. CT images at admission and 21days later at discharge. Bilateral subpleural arciform linear lesions were present at diagnosis and worsening of the extent and density of the abnormalities were noted at discharge. - Graph illustrating the correlation between CT score at baseline and at discharge: Patients above the dotted line showed an increase in the extent of parenchymal abnormalities while patients below the line showed a decrease in the parenchymal extent between admission and discharge. Blue dots represent CT analyses of patients who did not require ICU admission, orange dots represent CT analyses of patients who required ICU admission